Madera Energy, Inc.
One Broadway, 14th Floor
Cambridge, MA 02142
Tel: 617.401.2125
Fax: 617.401.3755
www.MaderaEnergy.com

12 August 2010

Mr. Phil Giudice
Commissioner
Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

Subject: Madera Energy Comments on DOER Biomass RPS Rulemaking Process

Dear Commissioner Giudice,

Madera Energy, Inc. submits the following comments regarding the letter to the Department of Energy Resources ("DOER") from Secretary Bowles dated July 7, 2010 ("Bowles letter") and the ongoing rulemaking process regarding the qualification of biomass energy systems under the Renewable Portfolio Standard (RPS). These comments supplement the comments that Madera Energy submitted to the DOER regarding the Biomass Sustainability and Carbon Policy Study ("Manomet Study") on July 9, 2010.

Madera Energy is the developer of the 47 MW Pioneer Renewable Energy (Pioneer) project based in Greenfield, MA. The Pioneer project would use clean, sustainably harvested waste wood fuel to generate enough renewable energy to power the equivalent of 45,000 homes (or approximately the number of homes in Cambridge).

Secretary Bowles' letter provides useful guidance for the rule-making process. DOER can make use of this guidance to draft these rules in a way that will maximize biomass renewable energy development (along with the attendant economic benefits) in a sustainable manner, consistent with the Commonwealth's greenhouse gas emission goals.

As we stated in our comments on the Manomet Study, we feel that the Study adds to the significant, and evolving, body of scientific literature on the subject of the carbon impacts of bio-energy. It should be seen as important, but not definitive, input to DOER's policy-making process. Unfortunately, the assumptions and scenarios in the Manomet Study limit its applicability to the current policy-making process. These assumptions and scenarios – such as the assumption that trees are cut for the purpose of producing biomass fuel and the use of a stand-level rather than a landscape-level analysis – dramatically overstate the carbon impacts of biomass-produced electrical energy. Because of the serious implications to the advancement of renewable energy in Massachusetts and beyond, Madera Energy urges DOER to obtain independent, technically-competent peer reviews of the Study before relying on it to justify significant changes in the state's RPS policy.

Madera Energy believes that biomass-fired electric power generation facilities that comply with mandated GHG reductions and fuel supply sustainability requirements should remain eligible to participate in the RPS.

This can be accomplished through revisions to the RPS regulations as follows:

1. The revised regulations should require each RPS-eligible biomass facility to achieve the "maximum practicable efficiency as determined by DOER." Any specific minimum efficiency thresholds should be "technology-specific" and should be promulgated through guidelines rather than regulations.

2. Should the Manomet methodology be utilized, which, as previously stated is largely at odds with other research on the subject, GHG compliance requirements should be based on the "carbon dividend" methodology as opposed to the "cumulative carbon dividend" approach, as the former more accurately characterizes the carbon profile of biomass utilization and is more consistent with typical accounting methodologies, including the recently released EPA Renewable Fuels Standard.

3. Fuel supply restrictions should allow RPS eligibility for all forms of clean "waste wood." Waste wood should be defined as all harvested forest products that are not sold for "commercial saw timber." Requirements for "sustainable forestry practices" should be promulgated through guidelines or best management practices (BMPs) in consultation with DCR and should be achieved and verified using forest cutting plans *approved* by licensed foresters in reference to rules used in MA under MGL c. 132.

We expand on these points below.

MAXIMUM PRACTICABLE EFFICIENCY

Secretary Bowles' letter puts significant emphasis on the need for biomass energy facilities to achieve the "maximum practicable efficiency". This is consistent, to a degree, with the RPS which has always required biomass projects to utilize "low-emission, advanced biomass Power Conversion Technology" to qualify. But the regulations should be revised in full recognition that "advanced" biomass technologies exhibit a range of efficiencies, depending on the application.

Thermal-led combined heat and power (CHP) systems that are sited adjacent to large, heat-consuming hosts can achieve high efficiencies, sometimes in excess of 60%. This is because they are designed mainly to produce heat, and can only produce electricity when and to the degree that there is a demand for heat. Often the ratio of heat production to electricity production in these plants can be more than 10 to 1. The Bowles letter seems to interpret Manomet to mean that only CHP and thermal applications are capable of producing the desired GHG reductions due to their higher efficiency. However, this in not accurate and also overlooks the fact that a tradeoff of thermal output for electric output is not an even trade.[1] It would be a basic mistake in devising revisions to the RPS rules to equate the importance of thermal efficiency with electrical efficiency, for several reasons.

[1] Even in the context of GHG reductions, generating electricity with biomass may help to avoid more carbon emissions than producing thermal energy, in absolute terms. For example, a biomass electric facility with lifecycle GHG emissions 50% lower than combined-cycle natural gas, would avoid 15kg of carbon for each mmbtu of heat input, if replacing coal-fired generation. A biomass thermal system with life-cycle GHG emissions 50% lower than the displaced gas or oil would avoid only 8kg or 11kg, respectively, for each mmbtu of heat input. (Based on life-cycle emission numbers presented in Manomet and typical efficiencies).

First, the apparent "inefficiency" of electricity generation as compared to thermal production should not obscure the important difference in the products they produce. Electricity is a highly refined and versatile product that is applied to a vast range of vital societal purposes (lighting, telecommunications, manufacturing, etc.). This is not the case with heat: its uses are limited and parochial, mainly for space and water heating, in locations immediately near to where it is generated. While CHP plants may be admirably efficient, substantial amounts of electricity are not available from this technology, mainly because of the design tradeoffs necessary to emphasize heat production and use. Plants designed exclusively or mainly to produce electricity may be less efficient, but they are producing a product that is far more valuable to society.

Second, the RPS is designed to incentivize electricity generation and should not be used to incentivize thermal efficiency because such an incentive already exists as a matter of state energy policy. The incentive structure for increasing plant efficiency was created through the Alternative Energy Portfolio Standard (APS) in the Green Communities Act. It is clear from the creation of the APS incentive for high-efficiency CHP plants that the legislature did not intend the RPS to become an incentive program for thermal efficiency and CHP facilities.

While the APS provides an incentive for thermal efficiency regardless of whether the fuel used is renewable, CHP plants that use woody biomass with high efficiencies would theoretically qualify for both the RPS and the APS incentives. In reality, however, it is unlikely that the APS CHP incentive would do much to spur the development of CHP projects in the context of biomass plants. This is due, in large part, because of the energy content and characteristics of the fuel would make it extremely difficult to meet and exceed the high thresholds set in the APS.

We would support modifications to the APS to better incentivize the thermal portion of biomass facilities but the proper vehicle for this is the APS rather than the RPS. The opportunity to achieve double incentives by altering the APS would provide the right market-based encouragement to the development of biomass-fired CHP plants that maximize efficiency.

Third, the RPS is funded by electric ratepayers who absorb the costs paid by retail power suppliers for RECs. As all RPS-eligible electricity generating projects displace non-RPS (often fossil-fueled) electric power, their costs and benefits are equally distributed among electric ratepayers. Not so, however, for thermal projects, where the benefit of the subsidy will go only to those few who actually receive the heat. (See our comments below on the large difference in cost per MW for electrical output between grid-scale biomass electric generation and biomass CHP.) An over-emphasis on plant efficiency would have the effect of spreading the accomplishment of the RPS goals across a larger number of smaller plants, with diminished economies of scale, thereby increasing the cost to ratepayers when the RPS goals are not met.

Recognizing the potential for a variety of technologies with a wide range of efficiencies to contribute value to society, the Bowles letter carefully avoids mandating enforcement of a single, high efficiency standard. Instead, he urges that there be a requirement for each plant to achieve its "maximum practicable efficiency as determined by DOER." Embodying this requirement, as is, in the RPS regulations would give DOER the ability to review proposed projects on a technology-by-technology basis and require each facility to improve its efficiency to the maximum practicable degree.

DOER could, for example, require that a facility plan for the addition of a thermal component to a primarily electric plant (say for nearby greenhouses or hospitals) if that were “practicable.” In doing so, it’s important to consider that these decisions are not always in the hands of the developer. In other words, a developer can’t dictate that a greenhouse or a hospital buy its heat. But a developer can design a facility to be able to provide heat and can attempt to negotiate supply agreements with potential off-takers. Considering biomass infrastructure is relatively long-lived and the market and incentives are constantly changing, it may make sense to require new electric-generating facilities to be designed and built to be “CHP-ready”. This would help to ensure that facilities take advantage of thermal opportunities should they present themselves in the future.

It would also allow DOER to establish guidelines that set forth efficiency targets, at realistic levels, for several different categories of biomass technology: such as combined heat and power, electric generation, pyrolysis, gasification, etc. These thresholds should be adopted through guidelines rather than regulations, since technologies will continue to improve over time. Once granted a Statement of RPS Qualification, the efficiency requirement in effect at that time should be applicable over the plant’s lifetime. Efficiency requirements should not be applied retroactively, as it is generally not possible to increase the efficiency of a plant once it is built and operating. The RPS portfolio will always have in it older facilities competing against newer facilities, and market forces will always provide a driver to maximize efficiency.

The danger of any minimum standard, whether a single or categorical version, is that it tends to eliminate eligibility for valuable projects and technologies simply because they fall slightly below the standard, even if they meet all other requirements. At the same time, it tends to discourage projects from becoming more efficient than the minimum, even if DOER sees readily available potential to push for greater efficiency. The primary justification given by advocates of a single, high efficiency standard is that forest resources are finite and should be reserved for technologies that may be developed in the future that could use the resource more efficiently. However, we have argued that they are not nearly so limited as suggested by the Manomet study. Their supply analysis was extremely conservative and contradictory to several recent studies. It was also predicated on a fundamentally flawed assumption – that high prices will be required to encourage landowners to sell biomass, when the reality is that only the removal cost of this material needs to be offset due to its negative value to the landowner. Though the price for biomass may rise in the future if supplies become short, however, other recent studies (cited in the attached letter) suggest that this in not imminent, due to their current abundance.[2] As the supply becomes tighter, high prices will provide a practical and efficient discouragement from overuse, and more efficient users will out-compete less efficient users. This is particularly true in a competitive energy market. In other words, we encourage the DOER to implement thoughtful yet rigorous sustainability standards and then let the market figure out which facilities are able to best make use of the resources.

In addition, as we noted in our attached July 9 comments on the Manomet Study, a limited number of larger electricity-led projects will be needed in Massachusetts to sustain the biomass harvesting infrastructure needed for projects of all sizes. This “anchor tenant” argument has been made by a number of people knowledgeable on the subject, including by Chris Recchia of the Biomass Energy

---

[2] This topic was discussed at length in Madera’s letter to the DOER in response to the Manomet study, which is attached hereto.

Resource Center ("BERC"), an organization that strongly supports the development of CHP and thermal projects. In a June 16, 2010 interview for the program "Vermont Edition", Mr. Recchia, who is also a member of the Manomet Study team, stated the following:

"Scale is a critical issue….it takes both [electricity-led and smaller scale CHP] in the sense that there is no one right answer here and it is a very complicated system".

As the interview progressed, Mr. Recchia went on to state the following:

"We recognize that – like a shopping center needs anchor stores – we may need some of the larger users in order to keep the infrastructure of logging and foresters in good business so that we can have them available for the smaller-scale projects".

This is an important point because relatively few operators in Massachusetts possess biomass chipping equipment due to a lack of markets, and adding this equipment would be a major investment for most small loggers. Based on research conducted by BERC, in order to make such an investment, a logger would need a large, consistent, and year-round demand for wood chips representing about 20,000 tons per year. According to the Vermont Department of Forests, Parks and Recreation, 10% of the student population in Vermont attends a wood heated school but this represents a total demand for chips of only about 14,000 tons per year[3]. Using the Vermont experience as a guideline and the research conducted by BERC, all of the schools using biomass for heating would be too small to support even a single logger in such an investment.

By contrast, McNeil Station and Ryegate, two electricity-led facilities in Vermont, together use approximately 700,000 tons per year. It is important to note that the anchor tenant does not necessarily need to be an electricity-led facility; large paper pulp, particleboard or pellet-producing facilities could fill the same role, however there has been little success in developing such industries in southern New England. A single, high efficiency standard that had the effect of eliminating RPS eligibility for electric generating facilities would eliminate the vital contribution to sustaining the wood supply industry made by these facilities and, by their exclusion, make the development of smaller CHP and thermal facilities extremely difficult.

It's also important to recognize the market barriers that make it difficult to develop and finance a CHP or thermal-led system. In Vermont, for example, the thermal applications became more prevalent largely as a result of extremely high state subsidies (paying up to 90% of system costs for some projects). In addition, in order to have a financially-viable project, whether electricity-led or CHP, a number of site conditions need to be "layered" on each other. These include sufficient truck access (away from residential neighborhoods), proximity to the fuel source, a credit-worthy counter-party willing to make a long-term supply commitment, consistent (preferably year-round) heating and electricity demand, and, in some cases, transmission access.

In other words, a hospital in downtown Boston may have a constant heating demand and may be willing to make a long-term commitment but they are not located near the fuel source and the area wouldn't be conducive to truck traffic. Likewise, a potential user in Western Massachusetts may be located close

[3] http://www.forestprod.org/smallwood06frederick.pdf

to the fuel source and have excellent truck access but may not have a constant need for the heat. Even a CHP project technically capable of achieving an efficiency of 60% or greater, will rarely do so when considered on an annual basis due to fluctuations in the demand for heat.

In addition, there is a dramatic cost differential between larger electricity-led systems and smaller CHP units. Consider the following two examples: Pioneer Renewable Energy's anticipated total installed cost for a roughly 50 MW electricity-led project is approximately $250 - $300 million, or between about $5000 and $6000/kW. On the other hand, a 2008 study of potential biomass CHP options for a Massachusetts college found the most favorable option to be a 500 kW system with an installed cost of over $10 million, or more than $20,000/kW.[4] This system was projected to generate less than 2 million kWh/yr, for a capacity factor of only 44%. With a simple payback of nearly 15 years, it is not surprising that this project has not progressed significantly. To produce the equivalent electrical output of a 50 MW base-load plant (90% capacity factor, nearly 400 million_kWh/yr) would require approximately 200 such systems and a total capital cost of over $2 billion. In the context of the RPS, which was established to transition the *electricity* sector away from fossil fuels, CHP systems will be an extremely challenging and costly strategy for achieving the RPS's goal.

This isn't to say that opportunities for CHP and/or thermal systems don't exist or should not be pursued, but rather, in considering the "maximum practical efficiency", it's important to consider the difficult hurdles that must be cleared for CHP and thermal facilities. It's also important to note that the viability of CHP systems is intrinsically tied to electricity-led systems. As Vermont has shown, and Mr. Recchia so clearly stated, large electricity-led plants and smaller CHP and thermal plants are not mutually exclusive, but rather can have a positive, symbiotic relationship. If the goal is to transition to a renewable, low-carbon energy economy, it doesn't make sense to discriminate against renewable technologies that can meet GHG reduction goals and fuel supply sustainability requirements. Below we discuss the practical considerations in adding these new compliance obligations for otherwise RPS-eligible biomass technologies.

GHG ACCOUNTING METHODOLOGY

As directed in the Bowles letter, "DOER shall establish a method for calculating and comparing such lifecycle greenhouse gas emissions based on the best available science and data". We recognize the challenge that this poses for DOER, as such methodologies are inherently complex and have often taken years to develop. We are concerned that DOER will devise its GHG methodology relying exclusively on the findings in the Manomet Study.

As discussed above, we question the validity of many of the assumptions and scenarios defined in the Manomet report because they diverge significantly from previously utilized methodologies, as well as actual experience and practice. In particular, we believe that any methodology that does not distinguish between biogenic and anthropogenic contributions to GHG impacts is destined to be proven fundamentally flawed over time. While the molecules are the same, the presence of these molecules in the atmosphere due to biogenic processes is inevitable, while with anthropogenic processes they are destined to remain sequestered but for human intervention causing their release. The emphasis of

[4] Combined Heat and Power Technical and Economic Feasibility Analysis for Springfield Technical Community College. Prepared for MA Division of Capital Asset Management by CEERE, UMASS Amherst. October 2008.

Manomet on the significance, from a climate change perspective, on the time difference between the release of biogenic GHG emissions through combustion and decomposition is exaggerated. We believe that the total amount of GHG emissions in the atmosphere over time is what matters for the purposes dealing with a global phenomenon like climate change. Fossil fuel use increases that total amount of GHG in the atmosphere. Biomass use merely accelerates the cycling of emission and sequestration of GHG that cannot otherwise be avoided. Nevertheless, if DOER intends to base its GHG compliance methodology on the Manomet Study, there are a number of potential pitfalls that DOER should avoid, as outlined below.

First, and most importantly, DOER should adopt a fair and realistic definition of the biomass life-cycle that is consistent with other methodologies (such as the EPA Renewable Fuel Standard). The Manomet Study provides two methods for comparing the GHG emissions of biomass and fossil fuel systems: "Carbon Dividend" and "Cumulative Carbon Dividend". The former relies on the correct definition of biomass' life-cycle. It examines the carbon impact of a single harvest (or all harvests in a single year) over time. When the biomass is initially harvested and burned, a carbon debt is produced (due to the greater carbon <u>stack</u> emissions of biomass combustion relative to fossil fuel combustion). Over time, however, the carbon debt of biomass is offset, and a carbon dividend is generated through avoided emissions from decomposition and carbon sequestration through forest re-growth.[5] Thus, the "Carbon Dividend" method accurately accounts for the full impacts of biomass use over its life-cycle.

By contrast, the Cumulative Carbon Dividend method examines the cumulative impact of biomass use on GHG levels over a limited time period (e.g. 40 years). This methodology has the effect of greatly overstating the carbon debt and understating the carbon dividends of utilizing biomass. This is because a carbon debt is generated in each year during the time period, but only the portion of the off-setting carbon dividends that fall within this window are counted. To illustrate this problem through an example, looking at cumulative GHG impacts over a period of 40 years, the forest stands harvested in year 1 will have 40 years to generate dividends through avoided decomposition and sequestration through forest re-growth, but the stands harvested in year 25 have only 15 years to recover, and for the stands harvested in year 40 no dividends are credited at all. Thus, in the cumulative methodology, the biomass energy system is penalized for the carbon debts incurred in each year due to combustion, but receives no credit for the carbon dividends that will continue to accrue beyond the end of the time period. Surely, in our efforts to reduce GHG emissions, it would be foolish to completely dismiss these dividends simply because they occur after an arbitrary point in time. Our efforts to combat climate change will not end in, say, 2050.

The difference in estimated GHG impacts when evaluated using these two methods is dramatic. For example, according to the Manomet Study, under harvesting scenario 2, biomass electric generation compared to coal generation, in 40 years, produces a net positive carbon dividend of 54% while the same comparison done using the cumulative method yields a much smaller positive dividend of only 11%.

Further, it should be noted that the Carbon Dividend method is consistent with how carbon impacts are calculated by other regulators. For example, the new U.S. EPA Renewable Fuel Standard for bio-fuels

---

[5] This could also be thought of as a rolling carbon dividend. Using a 40 year (2050) period, the stands harvested in year 1 would be evaluated in 2050, the stands harvested in year 2 would be evaluated in year 2051, and so on.

(known as "RFS2") evaluated the carbon benefits in a manner consistent with the Carbon Dividend approach rather than on a cumulative basis.

Second, the Bowles letter directs the DOER to ensure that credit is received only for "additional" carbon benefits that would not have otherwise occurred. On this point the methodology employed by Manomet is highly sensitive to the choice of the baseline forest growth and management practices. As has been pointed out by the study team, the choice of baselines is only applicable to Massachusetts and more work must be done to establish baselines for the rest of the region. By corollary you must also ensure that avoided emissions from waste wood that would have decomposed absent use for biomass energy are appropriately handled. While tree tops and limbs were covered, to an extent, in the Manomet Study, other, non-forest sources were not. Waste wood sources that would otherwise be land-filled or chipped and left to rot, may release their carbon much more quickly and sometimes in the form of methane, which would significantly improve the GHG impact of utilizing this material for energy.

Finally, care must be taken to ensure an "apples to apples" comparison of lifecycle emissions for the various fuels and technologies. Indirect GHG emissions associated with extraction, processing, and transportation of the fuel, and plant construction can have a significant impact on total life-cycle emissions, particularly in the case of natural gas. Life-cycle analyses are inherently complex and extremely dependent on the activities that are included and their estimated emissions. And much as biomass fuels are not all created equal, lifecycle emissions from natural gas can depend heavily on the source and extraction method.[6]

FUEL SOURCE SUSTAINABILITY

Madera Energy has always been committed to utilizing sustainably harvested wood fuel, and thinks that any such requirements need not conflict with its proposed project or fuel sources. We recognize that there is a call for additional oversight and accountability in this regard, but we must remember that the Commonwealth already has some of the most stringent forestry laws in the country, and we should strive to find the appropriate balance. We should not forget that, despite relatively weaker forestry laws and far more intensive biomass utilization in northern New England, forests there have continued to expand and are in many ways healthier than forests in Massachusetts. Despite the largely irrational fears of clear-cutting and deforestation expressed by some biomass opponents, we argue that a much more serious concern is the loss of forestland to development. Already, forest landowners face high costs in complying with Chapter 132 and other forestry laws – laws that make it increasingly difficult to earn income from their properties. To further increase the restrictions on the ability of these landowners to sell their forest products may well lead to more forests converted to shopping malls and housing developments.

As directed in the Bowles letter, DOER must define "'residues' and 'waste wood' to include residues from logging, land-clearing for commercial or residential development, mill residues and landscaping." For non-forest biomass (i.e. material that is not covered by Chapter 132, including land clearing), this is

[6] In fact, a recent study from Cornell University found that gas extracted from shale may be more carbon-intensive than coal - see: Robert W. Howarth, Cornell University, "Preliminary Assessment of the Greenhouse Gas Emissions from Natural Gas Obtained by Hydraulic Fracturing", 17 April, 2010

relatively simple, and the existing definition of "Eligible Biomass Fuel" which includes all clean wood should suffice. For biomass from the forest, we must make a careful distinction between saw timber and "residues." Nearly all harvests, whether the overall objective is long-term forest management, or short-term income generation, produce a combination of saw timber and residues.[7]

When the intent of the harvest is short-term income generation, we don't necessarily agree but understand that it may make sense to limit the amount of material that can be considered "waste wood." However care must be taken to ensure that such limits are both practical and enforceable. In many cases trees are cut and dragged whole to a landing for sorting into various products (saw timber, pulpwood, cordwood, chips). Any rule requiring weighing of material in the forest or at the landing would clearly be impractical. If the result of such limitations were piles of slash or chips at the landing – that would surely not reduce carbon emissions or contribute to nourishment of the forest floor.

We recommend that any such limitations be made carefully and in consultation with DCR and the forestry community as part of the broader "development of regulations that address fuel source sustainability", as directed by Secretary Bowles. We support the use of Best Management Practices (BMPs) along the lines of the work that the Forest Guild did for the Manomet Study but strongly recommend that foresters and landowners be given the flexibility to manage their land according to site-specific conditions and the land-management objectives that they want to meet. Certain mandates (e.g., 50% of tops and limps must be left behind) are arbitrary and extremely difficult to implement, measure, and enforce. They have the effect of intimidating landowners and foresters who cannot be confident they can demonstrate compliance, even with the best of efforts. We suggest that the RPS regulations point to a set of guidelines or BMPs that would ensure sustainability and cover such topics as residue retention and soil and water quality. As previously stated, we believe that it is more appropriate that these guidelines come out of the DCR rather than the DOER.

In the case of a long-term management harvest, as defined by DCR's regulations and approved by a licensed forester, all residues generated, including tops, limbs, and potentially whole trees, should be considered "waste wood," without limitation, provided that their removal promotes long-term forest health and are part of meeting other land management objectives. In this context, any trees and wood residues not sold as saw timber should be considered "waste wood", so long as the landowner complies with the afore-mentioned sustainability guidelines or BMPs.

To achieve the desired levels of accountability and oversight, it may be necessary to involve licensed foresters in the process. A requirement that harvests be performed in compliance with forest cutting plans *approved* by licensed foresters should serve this purpose. Indeed, this is already the case in MA, where all significant timber harvests require forest cutting plans approved by DCR Service Foresters, all of whom must be licensed foresters, under Chapter 132. In approving cutting plans, licensed foresters will verify the intent of the harvest (long-term management or short-term harvest), that the appropriate forestry laws, BMPs and sustainability guidelines have been followed, and that only materials meeting

[7] Chapter 132 Forest Cutting Plans currently require that all harvests be designated as either "Long-term Forest Management" or "Short-term Harvest." These two categories may provide a useful framework for defining "waste wood." In other words, if a landowner can justify through the Ch. 132 Cutting Plan why it's in the best long-term interests of the forest land, than any non-saw timber that is removed should be considered waste wood so long as it complies with reasonable silvacultural practices.

the definition of "waste wood" have been credited as such. Harvests in other states, as will often be the case, should be treated no differently.
Madera Energy appreciates the opportunity to submit these comments and look forward to continuing to be involved in the DOER regulatory process moving forward.

Sincerely,

Matthew Wolfe, Principal
MADERA ENERGY, INC.

Enclosures: Madera Energy July 9, 2010 Comments to the DOER on the Manomet Study

Madera Energy July 9, 2010 Comments to the DOER on the Manomet Study

Madera Energy, Inc.
One Broadway, 14th Floor
Cambridge, MA 02142
Tel: 617.401.2125
Fax: 617.401.3755
www.MaderaEnergy.com

9 July 2010

Phil Giudice
Commissioner
Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

Subject: Biomass Sustainability and Carbon Policy Study

Dear Commissioner Giudice,

In response to the recent release of the Biomass Sustainability and Carbon Policy Study by the Manomet Center for Conservation Sciences (the Manomet Study, or Study), and your letter dated June 10, 2010 requesting comments on this subject, Madera Energy, Inc. is pleased to submit this comment letter. Madera Energy is the developer of the 47 MW Pioneer Renewable Energy (Pioneer) project based in Greenfield, MA. The Pioneer project would use clean, sustainably harvested waste wood fuel to generate enough renewable energy to power the equivalent of 45,000 homes (or approximately the number of homes in Cambridge).

First, we would like to commend you for commissioning this Study and for your continued attention to these important issues. We would also like to applaud the Manomet Center and the other contributors to the Study for their efforts, which have added significantly to the body of scientific work on these topics.

In general, we agree with the study's conclusion that sustainably-harvested biomass, and waste wood in particular, can yield significant carbon dividends over time when utilized to replace fossil fuel sources of energy. In addition, we find Manomet's evaluation of harvesting regulations and recommendations to ensure biomass fuels are harvested sustainably to be very well considered and reasonable. The proposed measures seem to find an appropriate balance and should help to allay many of the fears expressed by the public on this issue. We also look forward to participating actively in the upcoming rulemaking process with regards to the RPS.

There are, however, a number of issues that we feel must be raised with respect to the Study's scope and methodology, as well as the manner in which the study has been characterized. First, the study failed to fully evaluate the use of waste wood – the intended fuel source for our Pioneer Renewable Energy project. Related to this, the Study grossly underestimated the quantity of wood fuel economically available based on a lack of understanding of the biomass fuel market, though the Study did confirm that a significant amount of supply is available on a sustainable basis. In addition, the study did not fully recognize the benefits of electricity-led biomass systems, and its use of a stand-level as opposed to a landscape approach to carbon modeling resulted in an understatement of the carbon benefits of biomass utilization. Finally, the characterization of the study results was misleading, and has been disputed by several of the study's authors.

The Study Did Not Evaluate the Positive Carbon Impacts of Using Waste Wood

Of critical importance is the failure of the Manomet Study to fully evaluate the impacts of using waste wood for energy production. As noted in the executive summary, the study did not "…consider non-forest sources of wood biomass (e.g., tree care and landscaping, mill residues, [land clearing,] construction debris), which are potentially available in significant quantities but which have very different greenhouse gas (GHG) implications"[1] from the harvesting of standing trees. The term "waste wood" is not well-defined, but should be extended to include residues from logging operations, including tree tops and branches in addition to the non-forest sources, which are recognized to have similar carbon profiles.[2] Currently operating biomass power facilities in Massachusetts, throughout New England, and across the country rely on such waste wood sources for virtually all of their fuel supply. Proposed projects, such as Pioneer Renewable Energy, would be no different. Thus, the study's results regarding carbon debts and dividends don't apply to virtually all of the facility's fuel supply, which would have significantly greater carbon benefits. In fact, the Study states that "…all bioenergy technologies—even biomass electric power compared to natural gas electric—look favorable when biomass 'wastewood' is compared to fossil fuel alternatives".[3]

Another important point that is ignored by the Manomet Study regards the purpose of the biomass harvest. The study assumes that standing trees which are harvested in the biomass scenarios are cut for the sole purpose of providing fuel. In practice this would rarely, if ever, be the case. This has been demonstrated by the decades-old biomass energy industry in northern New England. The market for low-grade biomass that is created by biomass energy facilities merely helps to offset the cost of removing trees that the landowner desires to have removed for other reasons, including forest management, wildlife habitat creation, and aesthetics.

Without a market for low-grade wood, these trees, whose removal can have a positive impact on forest management, end up having a negative value to the landowner as they desire to have them removed to meet the previously discussed land management objectives. This material has little or no commercial value and its removal is often cost-prohibitive. A market for low-grade biomass thus assists landowners in furthering their land management goals. Clearly, the harvesting for biomass of trees that have value (or potential future value) as sawlogs (often demanding > $100/ton) would not be a rational decision, with biomass often going for stumpage prices as low as a few dollars per ton. In the case where a tree is

[1] Page 6
[2] Page 110
[3] Page 110

cut for the purpose of improving forest management and then utilized for energy, the biomass power facility is merely providing an appropriate disposal outlet, and this material should therefore be treated as "waste wood" from a carbon perspective.

Though not included in its main conclusions, the Manomet Study does provide some information that helps to evaluate the carbon impact of using waste wood. The study considers a case where only tops and limbs are harvested from the forest, and finds that 87% of the harvested carbon is recovered within 20 years, and that these results "…may be representative of situations involving non-forest biomass sources…".[4] If not collected and utilized for energy, these waste wood materials will decompose and return their stored carbon to the atmosphere relatively quickly, while the forest continues to grow around them. As detailed above, forest management-derived biomass should have the same carbon profile as this waste wood. Utilizing Manomet's formula for determining carbon dividends[5], a biomass electric generating facility fueled with waste wood would yield a carbon dividend in 20 years of more than 80% when compared to coal, and more than 60% when compared to natural gas. Seeing as such data were available to Manomet as they wrote the study, we feel that these important conclusions should have been incorporated.

The Biomass Supply Analysis Confirmed That a Substantial Amount of Fuel is Available on a Sustainable Basis but Incorrectly Applied the Economic Analysis

Chapter 3 of the Manomet study provides a fairly detailed analysis of the technical and economic availability of biomass fuels in the Commonwealth on a sustainable basis. These questions have been asked several times before, most recently and exhaustively as a part of the DOER's Sustainable Forest Bioenergy Initiative (SFBI) in 2007 and 2008. These studies looked at both the sustainable yield of the state's forests, and the availability of non-forest waste wood, as well as the price for fuel delivered to potential Massachusetts-based bioenergy facilities. In 2002, a study published by the Massachusetts Biomass Energy Working Group estimated that there were 1.9 million tons of unutilized net biomass growth within the state's forests every year.[6] A study by Innovative Natural Resource Solutions (INRS) as part of the SFBI in 2007, concurred with this figure, but suggested that only 50% of this quantity would be available to biomass energy projects, leaving approximately 950,000 green tons per year that could be utilized on a sustainable basis.[7] The INRS study went on to suggest that 50% of unutilized net forest growth in the neighboring counties of NH, VT, NY and CT could provide nearly 6 million additional tons per year of biomass fuel to Massachusetts facilities. And yet another SFBI study, this one focused specifically on the silvacultural and ecological impacts of biomass harvesting, found that the state's

[4] Page 110

[5] Page 111. Carbon dividend = (total carbon recovered – carbon debt)/(total carbon emissions – carbon debt). The 20 year carbon dividend for waste wood utilized to offset coal electric, thus = (87 – 31) / (100 – 31) = 81%

[6] Massachusetts Biomass Energy Working Group. *The Woody Biomass Supply In Massachusetts: A Literature-Based Estimate.* May 2002.

[7] Innovative Natural Resource Solutions, Biomass Availability Analysis – Five Counties of Western Massachusetts. January 2007.

forests could support a sustainable harvest of between 950,000 tons and 1.7 million tons annually, excluding saw-quality logs.[8]

Interestingly, the Manomet study arrived at a similar figure for biomass supplies available in MA on a sustainable basis (up to 885,000 tons per year), however this figure was then reduced to between 150,000 and 250,000 tons by their analysis of economic availability (i.e., the Low Price Scenario). In addition, when compared to studies by INRS and others, Manomet's projection for biomass available to Massachusetts project from neighboring states (515,000 to 665,000 tons/year) is extremely conservative.

Unfortunately, there is a fundamental flaw in the economic analysis conducted by Manomet, and this has implications throughout the Study. Manomet treats biomass as a commodity which results in its availability being highly reliant on price. In reality, biomass fuel, particularly in regards to electric generating facilities, is typically a waste or by-product from commercial timber harvesting or forest management. As described earlier in this letter, biomass energy facilities simply provide an outlet for material that has a negative value to landowners, and only need pay a price high enough to help offset the removal cost. Biomass electric generating facilities throughout the Northeast have typically paid very low stumpage prices for their fuel over the past 20+ years. Manomet is correct to suggest that sending loggers into the woods for the purpose of harvesting biomass fuel would be costly, however this rarely if ever occurs in practice. Manomet's failure to grasp this reality, suggests a discomforting lack of understanding of the way the biomass fuel market functions in the Northeast.

As noted previously, the Manomet Study makes only peripheral mention of non-forest sources of biomass, however is does concede that these sources "may be substantial and worthy of further investigation".[9] In fact, non-forest sources of waste wood have been studied extensively, both as part of the SFBI and elsewhere, and have been shown to be abundant in Massachusetts, and likely to comprise a significant proportion of the fuel supply of any biomass power facility located in the Commonwealth. Such fuels are very favorable from a carbon perspective, and also often less expensive than forest-derived fuels. While Manomet establishes a reasonable upper bound for the price a biomass electric generating facility could afford to pay ($31/ton, delivered), it fails to account for the fact that lower cost fuels are typically used to offset the cost of more expensive fuels, thereby greatly extending the reach of the facility.

As part of the SFBI, INRS also conducted an economic analysis for biomass fuels, considering both forest and non-forest sources. For a hypothetical 50 MW biomass plant located in Pittsfield, INRS concluded that more than 800,000 tons/year of wood fuel would be available at a weighted average price of approximately $26/ton, delivered.[10] Similar conclusions were also drawn for Springfield and Worchester. Notably, these volumes are all available for less than Manomet's threshold price for electric generators,

[8] Kelty, et al, Silvacultural and Ecological Considerations of Biomass Harvesting in Massachusetts. January 2008.
[9] Page 36
[10] Innovative Natural Resource Solutions, *Biomass Availability Analysis – Pittsfield, Massachusetts.* January 2007.

and are within Manomet's "Low-Price" scenario (< $30). With such studies commissioned by the DOER so recently, and conducted by extremely well-respected subject matter experts with decades of experience in this field, it is interesting that DOER felt the need to ask these questions again so soon, and even more interesting is their apparent willingness to accept the new results which are contradictory to past work.

It is important to emphasize, however, that from a sustainability perspective, the Manomet Study and the afore-mentioned studies came to very similar conclusions. In other words, the Manomet Study confirmed that there is an abundant supply of fuel available on a sustainable basis. We question their conclusion that the supply is only available at higher prices but we agree with the conclusion that a significant amount of power can be generated sustainably using this resource.

The Study Failed to Fully Recognize the Benefits of Electricity-Led Systems and the Difficulty of Developing and Financing CHP Systems

The Study, and in particular the way that the results of the Study have been characterized, seems to position the issue as a choice between electricity-led and CHP systems. But this ignores the symbiotic relationship that the two can play in helping to achieve the policy goals of the Commonwealth. This point was conspicuously absent from the Study but was made by one of its authors in an interview with Vermont Public Radio soon after its release. In the June 16 interview for the program "Vermont Edition", Study team member Christopher Recchia from the Biomass Energy Resource Center stated the following:

> *"Scale is a critical issue….it takes both [electricity-led and smaller scale CHP] in the sense that there is no one right answer here and it is a very complicated system".*

As the interview progressed, Mr. Recchia went on to state the following:

> *"We recognize that – like a shopping center needs anchor stores – we may need some of the larger users in order to keep the infrastructure of logging and foresters in good business so that we can have them available for the smaller-scale projects".*

A similar point on the relationship between electricity-led and CHP systems was also clearly stated in a June 2010 study from the European Climate Foundation entitled Biomass for Heat and Power. This study refers to larger-scale electricity-led systems as "energy producing industry". It states the following[11]:

> *"There are two main sectors of final energy consumption where ligno-cellulosic biomass use could be scaled up: the energy-producing industry and smaller-scale heating applications. Both*

[11] http://www.europeanclimate.org/index.php?option=com_content&task=view&id=77&Itemid=42

> *segments have their advantages as users of biomass: the energy-producing industry consists of large companies that have important infrastructure elements already in place, that have the capacity to make large and long-term investments, and that can mobilize quickly. As forest ownership and farming is fragmented in most countries, many voices argue that involving the energy producing industry is crucial to create a large-scale biomass industry. Because biomass in energy production to a great extent displaces coal combustion, it is also more effective in reducing carbon dioxide emissions than biomass in direct use heating, where it displaces oil and gas. The smaller-scale "direct use" heating segment has the advantage of a higher direct conversion efficiency than electricity – often 80% compared to 35-40% for electricity, and since Europe's current renewable energy target is formulated in terms of final energy consumption, the "direct use" heating segment would allow Europe to meet its targets with the lowest possible total amount of biomass. To deliver on the expected 850 TWh growth from biomass by 2020, a substantial demand increase from* ***both segments*** *is likely required." (emphasis added)*

One does not have to look at Europe, however, to find examples of how electricity-led and CHP systems can benefit each other. Vermont has had two larger, electricity-led biomass plants for more than twenty years. This includes the 50 MW McNeil Station in Burlington and the 20 MW plant in Ryegate. As was suggested by the EU report, these "energy producing industry" plants were able to get into operation relatively quickly to begin generating locally produced power. And, as Mr. Recchia suggests, these plants served as "anchor tenants" which help build up the infrastructure and year-round demand needed to sustain the smaller CHP plants. This has led to the development of a biomass CHP project at Middlebury College, as well as proposed District Heating projects in Montpelier and Brattleboro. There are also dozens of schools in Vermont that use biomass for heating. Since these are largely seasonal users, it would be difficult to impossible for them to exist without the substantial, year-round demand created by McNeil and Ryegate, which has sustained the forest products industry in the state despite the decline of the pulp and paper industry in New England.

We find it perplexing that this point was made so clearly by the EU report (which came out the same day as Manomet) and in the comments by Mr. Recchia (which he made within a week of the release of the Manomet Study) but was not made in the Study itself. The Study seems to infer that electricity-led and CHP systems are mutually exclusive, when, in fact, the two can co-exist quite nicely.

The Study also fails to recognize the market barriers that make it difficult to develop and finance a CHP-led system. In order to have a financially-viable project, whether electricity-led or CHP, a number of site conditions need to be "layered" on each other. These include sufficient truck access (away from residential neighborhoods), proximity to the fuel source, a credit-worthy offtaker/counterparty willing to make a long-term commitment, consistent heating (preferably year-round) and electricity demand, and, in some cases, transmission access.

In other words, a hospital in downtown Boston may have a constant heating demand and may be willing to make a long-term commitment but they are not located near the fuel source and the area wouldn't be conducive to truck traffic. Likewise, a potential user in Western Massachusetts may be located close to the fuel source and have excellent truck access but may not be credit-worthy or have a constant need for the heat. Even a CHP project technically capable of achieving an efficiency of 70% or greater, will rarely do so when considered on an annual basis due to fluctuations in the demand for heat.

In addition, there is a dramatic cost differential between larger electricity-led systems and smaller CHP units. Consider the following two examples: Pioneer Renewable Energy's anticipated total installed cost for a roughly 50 MW electricity-led project is approximately $250 - $300 million, or between about $5000 and $6000/kW. On the other hand, a 2008 study of potential biomass CHP options for a Massachusetts college found the most favorable option to be a 500 kW system with an installed cost of over $10 million, or more than $20,000/kW.[12] With a simple payback of nearly 15 years, it is not surprising that this project has not progressed significantly. To produce 50 MW of electricity in this way would require 100 such systems and a total cost of over $1 billion. In the context of the RPS, which was established to transition the *electricity* sector away from fossil fuels, CHP systems would appear to be an extremely challenging and costly avenue to achieving this goal.

This isn't to say that opportunities for CHP systems don't exist or should not be pursued, but rather, in considering the market for these opportunities, it's important to consider the difficult hurdles that must be cleared. It's also important to note that the viability of CHP systems is intrinsically tied to electricity-led systems. As Vermont has showed, and Mr. Recchia so clearly states, large electricity-led plants are needed to establish and sustain the biomass fuel market and infrastructure, which in turn enables the development of smaller CHP projects.

The Study Exaggerated the Carbon Impacts of Biomass Due to its Use of a Plot-Level Approach

In modeling forest carbon sequestration, two primary modeling strategies have been employed by the scientific community; the plot (or stand) level approach, and the landscape or regional approach. The latter approach, as the name suggests, looks at carbon sequestration over an entire region. In the context of forest biomass utilization, the landscape approach suggests that if forest carbon stocks are stable or increasing in the region, then there is no net loss of carbon across the supply region and therefore no carbon debt to repay. On the other hand, the plot-level approach, which was utilized in the Study, attempts to model the carbon recovery for each acre that is harvested. Such analyses ignore carbon uptake on other un-harvested plots in the region that will supply biomass energy facilities in future years, and in so doing, overstate near-term carbon emissions from biomass energy.

Importantly, that Study shows that "the combined volume of timber and biomass harvests [in the Low-Price scenario] represent less than half of the annual net forest growth across the state's operable

[12] Combined Heat and Power Technical and Economic Feasibility Analysis for Springfield Technical Community College. Prepared for MA Division of Capital Asset Management by CEERE, UMASS Amherst. October 2008.

private forest land base"[13], meaning that forest growth far exceeds harvest. Even under its high-price biomass supply scenario forest carbon stocks will continue to increase.

The landscape approach was used in the recently released European Climate Foundation report entitled "Biomass for Heat and Power" (herein, EU Study). The EU Study was released on the same day as the Manomet Study. Using the landscape approach, the EU Study found that biomass energy was 98% carbon neutral, so long as carbon stocks within the control area are constant or increasing and the volumes of harvested biomass must never exceed the annual incremental growth of the forest. This report states that, "as long as the harvested volumes never exceed the total annual growth of biomass in the forest, carbon sequestration is, for all practical purposes, continuous"[14].

The EU Study continues with a brief question and answer section to describe this point in greater detail. It reads as follows:

> *Q: Doesn't cutting and burning trees cause CO2 emissions?*
> *A: With a single tree view, when a tree is cut and then burned, the stored carbon is released into the atmosphere as CO2. To re-grow the tree, and re-absorb the CO2, takes decades.*
>
> *Q: But how can then biomass be a way to reduce CO2 emissions?*
> *A: In reality, a single tree forms part of a larger forest system. Trees corresponding to a sustainably managed forest's net growth*[15] *can thus be harvested since other trees in the forest will continuously absorb as much CO2 as is emitted by burning the harvested trees.*
>
> *Q: What is best from a climate viewpoint, to use forests or to leave them untouched?*
> *A: Using a sustainably managed forest for energy or other products abates more CO2 than if the forest is left untouched, as forest growth flattens out over time.*

The plot level approach also doesn't recognize the difference between anthropogenic and biogenic carbon emissions. As the above Q/A explains, "*a single tree forms part of a larger forest system".* In other words, a tree "rents" carbon which will eventually be released and then absorbed by another tree that is part of the same system. The carbon that is released when a tree either decays or is combusted should be considered biogenic carbon, as it is part of the natural carbon cycle.

In contrast, generating power from fossil fuels involves extracting long-sequestered carbon and then releasing that into the atmosphere. As this fossil carbon would have remained in permanent

[13] Page 8
[14] http://www.europeanclimate.org/index.php?option=com_content&task=view&id=77&Itemid=42
[15] Net growth is defined as the total forest growth volume at system level minus total harvested volume. The system for which net growth is calculated is typically a region or a country. E.g. in Sweden annual growth is ~110million m3, of which ~90million m3 is harvested, leaving a net growth of ~20million m3.

sequestration absent human activity, its release into the atmosphere should be considered anthropogenic. Treating these two "systems" in the same way ignores this important distinction. The replacement of fossil or anthropogenic carbon emissions with biogenic carbon will, over time, help to stabilize GHG levels in the atmosphere, as biogenic emissions have no net impact on the climate. And, as stated in the EU study, managing our forests will help to reduce GHG levels by increasing sequestration rates.

The Press Release on the Manomet Study was Misleading and Mischaracterized the Results

The lead of the June 10 press release from the Patrick Administration regarding the Manomet Study stated that the "r*eport shows that electricity from biomass compares unfavorably with coal".* The release continues with a statement from Secretary Ian Bowles, "But now that we know that electricity from biomass harvested from New England forests is not 'carbon neutral'… we need to re-evaluate our incentives for biomass." Not surprisingly, the media accepted the Administration's summary as accurate and this statement immediately formed the basis of local and national headlines - on the same day, the Associated Press piece on this subject was titled "Mass. study: Wood power worse polluter than coal."

The "worse than coal" characterization presented by the Patrick Administration was quickly refuted by one of the authors of the study, the Pinchot Institute, which released a statement the following day, noting that:

> ***"Bioenergy technologies, even biomass electric power compared to natural gas electric, look favorable when biomass waste-wood is compared to fossil fuel alternatives"*** *(emphasis added)… In addressing the specific question of whether wood biomass electricity can reduce carbon emissions relative to fossil fuels, the study concluded that carbon emissions per unit of electricity generated can be higher with wood, based on the more concentrated energy content of fossil fuels such as coal or natural gas. However, this conclusion is not meant to address the additional significant environmental, economic, and social effects of fossil fuel use,* ***nor does it reflect that electric power generation from forest residuals and waste wood results in minimal if any net carbon emissions*** *(emphasis added). Both of these factors are important to consider in policymaking relating to opportunities to substitute renewable energy sources for fossil fuels.*

Other organizations involved in the study also released clarifying statements stating that the conclusions of the report were misinterpreted and that biomass is NOT worse than the coal but rather can be quite beneficial from a carbon perspective. Specifically, they stated the following:

The Manomet Center for Conservation Sciences released a statement saying that much of the media coverage had oversimplified the results and that the "wood worse than coal" headline for GHG emissions is "an inaccurate interpretation(s) of our findings, which paint a much more complex picture."

The Biomass Energy Resource Center (BERC), a partner in the study, said that the "policy actions and recommendations as expressed by the Commonwealth of Massachusetts come entirely from the

Commonwealth, not the study." BERC also disputed the "biomass worse than coal" statement and noted that the AP headline "is not a conclusion that can be gleaned from this study, and is entirely inaccurate."

It is also important to note that the Administration's press release focused on the entirely wrong piece of data. The "worse than coal" assertion is a reference to the "cumulative carbon dividend" for biomass electric compared to coal in 2050.[16] The cumulative carbon dividend as utilized in the Manomet study is an inappropriate method of calculating carbon impacts and has the effect of greatly understating the carbon benefits of utilizing biomass for energy. The cumulative carbon dividend is the sum of the carbon dividends generated from the harvest and utilization of biomass in each year. Looking at 2050 (40 years), the forest stands harvested in year 1 will have 40 years to recover carbon, but the stands harvested in year 10 have only 30 years to recover, and the stands harvested in year 40 have no time at all to recover carbon. Thus the biomass energy system is penalized for the carbon debts incurred in each year due to combustion, but receives no credit for the carbon dividends that will continue to accrue beyond 2050.

A more appropriate, and much more common, approach is to evaluate the carbon dividend generated through the harvest and utilization of a single stand at a point in the future.[17] In the Study, this is called simply the "carbon dividend."[18] In stark contrast to the cumulative approach, this method yields carbon dividends of 32% and 54% for biomass electric compared to coal in 2050 for harvesting scenarios 1 and 2, respectively. This is more consistent with how carbon benefits are traditionally counted. For example, the new EPA standards on biofuels (RFS2) evaluated the carbon benefits in a manner more in line with the simple carbon dividend approach rather than on a cumulative basis. Using this methodology, biomass for electricity using waste wood would result in even greater carbon dividends. As detailed elsewhere in this letter, using waste wood results in a carbon dividend of approximately 60% compared to combined cycle natural gas within 20 years (and nearly 90% in 40 years). The carbon dividend compared to coal would be more than 80% in 20 years and nearly 95% within 40 years.

Given this information, corrective action on behalf of the Patrick Administration and the Manomet Center is necessary to rectify the public perception that was created by these mischaracterizations. As demonstrated above, the Study was far more complicated, and far less damning than the Administration's comments would suggest. The inaccurate statements quickly gained national and international attention and significant damage was done. The timing of these statements at a critical juncture for both state and federal energy policy further underscores the need to exercise caution when summarizing such a complicated report. We join with others in strongly encouraging the Administration to publicly correct and clarify their characterization of the Manomet study and their position with regards to biomass energy. We also encourage the Administration to conduct a peer review by leading

[16] See Exhibit 6-14, page 112. Biomass electric has a cumulative carbon dividend of -3% in 2050 when compared to coal under harvesting scenario 1. Harvesting scenario 2 shows a carbon dividend of +11% in the same year.
[17] This could also be thought of as a rolling carbon dividend. Using the 40 year (2050) example, the stands harvested in year 1 would be evaluated in 2050, the stands harvested in year 2 would be evaluated in year 2051, and so on.
[18] See Exhibit 6-13, page 112.

national forestry, biomass and renewable energy scholars referred by the National Renewable Energy Laboratory and/or a cadre of university presidents overseeing renewable energy centers.

We appreciate the opportunity to submit these comments and look forward to continuing to be involved in the process moving forward. Please let us know if you have any questions.

Sincerely,
MADERA ENERGY, INC.

Matthew Wolfe, Principal